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## 6.12 NOISE CONTROL

This section presents an evaluation of sound levels associated with the Project. The Site is located in the northeast corner of the City of Avenal, approximately 6 miles northeast of the business and residential districts of the City, 2 miles east of Interstate 5, and 200 feet southwest of the California Aqueduct. It is 16 miles east of the City of Coalinga and 28 miles southwest of Hanford, the Kings County seat. The Site is comprised of land that is zoned industrial and currently used as farmland. Land uses in the vicinity of the Site are comprised of agricultural uses, with sporadic farmhouses and industrial uses. The closest sensitive noise receptors are farmhouses that are northeast and southwest of the Site, approximately 1.3 and 1.8 miles away, respectively. A City of Avenal water treatment plant is located adjacent to the northeast corner of the Site.

### 6.12.1 EXISTING CONDITIONS

#### 6.12.1.1 Applicable Noise Standards

##### 6.12.1.1.1 General

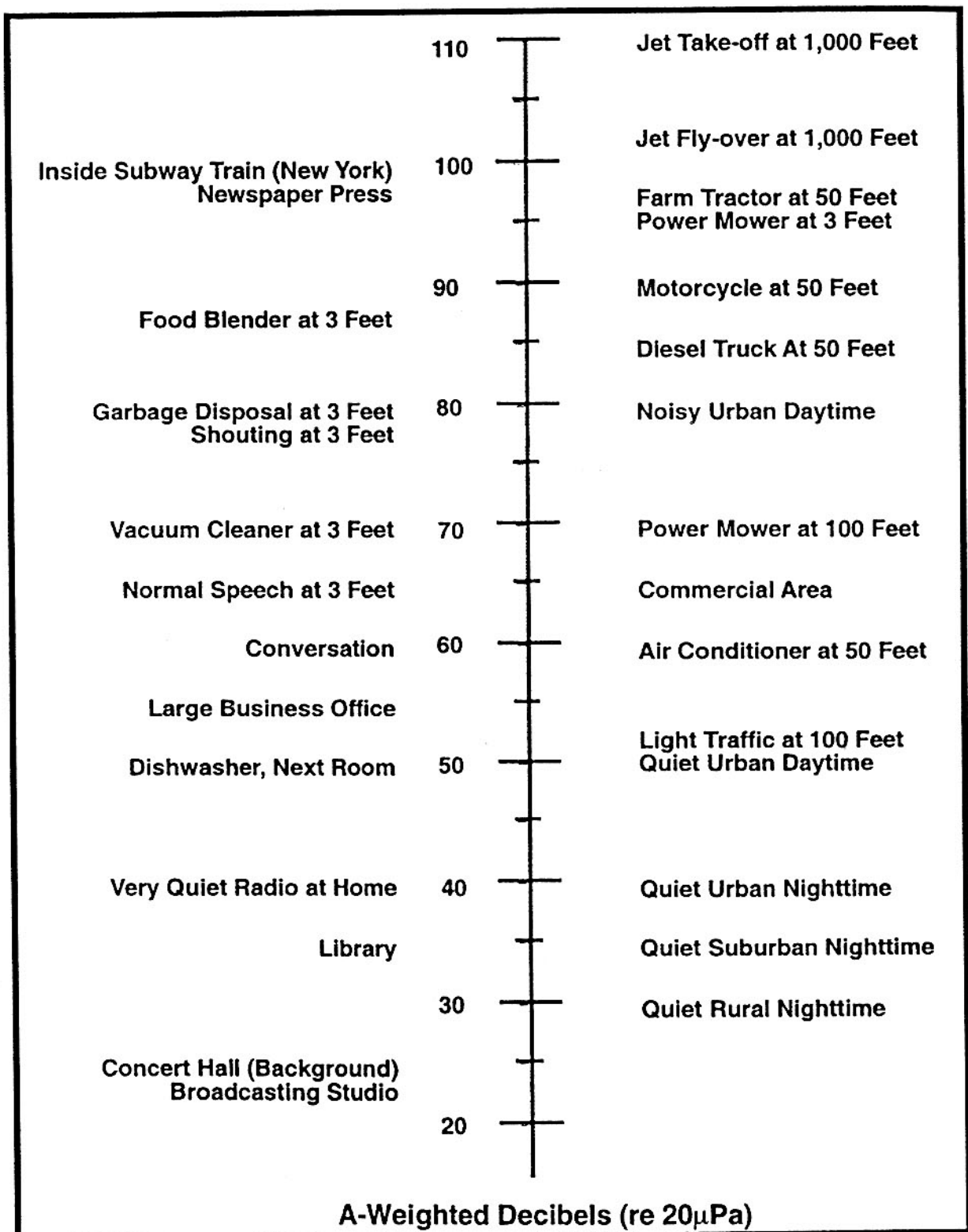
Excessive noise can result in annoyance and potential health effects. Annoyance can include sleep disturbance and speech interference. It also can distract attention and make activities more difficult to perform (EPA, 1978).

The range of pressures that cause vibrations that create noise is large. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). Noise is typically measured on the A-weighted scale (dBA), which has been shown to correlate with human response to sound and is the most widely used descriptor for community noise assessments (Harris, 1991). Figure 6.12-1 provides examples of various outdoor and indoor noises and their typical A-weighted noise levels.

Common descriptors of noise include the Equivalent Noise Level ( $L_{eq}$ ) and statistical sound levels ( $L_{90}$ ,  $L_{50}$  and  $L_{10}$ ). Additional composite descriptors include the Day-Night Level ( $L_{dn}$ ) and Community Noise Equivalent Level (CNEL). These descriptors are defined below.

$L_{eq}$

The Equivalent Noise Level over a specified period of time (e.g., 1 hour). It is a single value of sound that accounts for the same sound energy as the actual varying sound levels over the given period of time.



Source: Compiled by Hodges & Shutt from various sources (Dec 1993)

Figure 6.12-1 Typical A-weighted Sound Levels.

Statistical Sound Levels	The A-weighted $L_{90}$ , $L_{50}$ and $L_{10}$ are sound levels that are exceeded a certain percentage of the time. The $L_{90}$ is the sound level exceeded 90 percent of the time and is often considered the residual background noise level. The $L_{50}$ is the level exceeded half the time (50 percent) and is the median sound level. The $L_{10}$ is the sound level exceeded 10 percent of the time and is a measurement of intrusive sounds, such as aircraft flying overhead.
L <sub>dn</sub>	The $L_{dn}$ is defined as the Day-Night Noise Level. It is the A-weighted sound level over a 24-hour period with a 10 dB penalty for sounds that occur between 10 p.m. and 7 a.m.
CNEL	The CNEL is defined as the Community Noise Equivalent Level. The CNEL was developed in California for evaluating noise levels in residential communities. The CNEL is similar to the $L_{dn}$ in that it is also a 24-hour metric and it also includes the +10 dB nighttime adjustment, but the CNEL adds an additional 5 dB to sounds that occur between 7 p.m. and 10 p.m.

#### 6.12.1.1.2 City of Avenal

Community noise controls are addressed in the City of Avenal General Plan Noise Element (City of Avenal, 1992). The noise standard within the Noise Element states that, noise created "by new proposed stationary noise sources...shall be mitigated so as not to exceed the noise level standards on lands designated for noise-sensitive uses." Noise-sensitive land uses include residential dwellings, schools and hospitals. The City's standards establish a maximum allowable hourly equivalent noise level, denoted as  $L_{eq}$  (see the definitions above), depending on time of day. For daytime hours (between 7 a.m. and 10 p.m.), the  $L_{eq}$  limit is 50 dBA, while the nighttime (between 10 p.m. and 7 a.m.) limit is 45 dBA. The City's standards also limit the maximum noise levels from stationary sources to 70 dBA during the daytime (between 7 a.m. and 10 p.m.) and 65 dBA during the nighttime (between 10 p.m. and 7 a.m.).

The City's noise standards provide control so that unnecessary, excessive and/or annoying sounds from a development or use on a given piece of property do not have a significant adverse affect on other properties. By comparing existing noise levels and noise level standards to the expected noise levels that will be generated by the Project, the effect of Project-related noise can be determined.

#### 6.12.1.1.3 Kings County

Although the Project is within the City of Avenal, the City - County boundary is adjacent to the north and east Site boundaries; therefore, the Kings County noise standards are addressed herein.

Community noise controls are addressed in the Kings County Noise Element (Kings County, 1993). The County Noise Element contains an objective and policies to achieve the County's stated goal, "To ensure the compatibility of adjacent land uses by requiring appropriate noise reducing mitigation measures." The following objective and policies from the King's County Noise Element are applicable to the Project.

#### Objective

40.1 "Avoid incompatibility of adjacent land uses by requiring appropriate noise reducing mitigation measures."

#### Policies

40a "Information shown in Table 18, Appendix 8, as Kings County policy regarding the compatibility of land uses and noise levels produced or received." (See Table 6.12-1.)

40b "Require developers of projects expected to produce excessive noise to mitigate the effects of the excessive noise on existing land uses."

40c "Require developers of noise-sensitive projects to mitigate for existing excessive noise sources which may be expected to impact the project."

The Kings County Noise Element establishes compatibility for various land-use categories with respect to exterior community noise levels. The noise dB ranges (given in terms of  $L_{dn}$  or CNEL) are described as "acceptable," "conditionally acceptable," and "unacceptable" for each land-use category. The land-use category that most closely applies to the nearest residential receptors is 'Residential - Rural Residential.' For other nearby land uses, the appropriate category is 'Agricultural - Agricultural and Intensive Agricultural.' The exterior noise exposure allowances under the Kings County Noise Element are summarized in Table 6.12-1.

**TABLE 6.12-1**

**KINGS COUNTY EXTERIOR NOISE EXPOSURE ALLOWANCES  
RESIDENTIAL AND AGRICULTURAL LAND USES ( $L_{dn}$ )**

Land Use Category	<65 dBA	65 - 70 dBA	70 -75 dBA	> 75 dBA
Residential (Rural)	Acceptable	Conditionally Acceptable	Unacceptable	Unacceptable
Agricultural	Acceptable	Acceptable	Conditionally Acceptable	Unacceptable

Source: Kings County General Plan, December 1993, Noise Element, Appendix 8, Table 18, "Compatibility of Land Uses to Noise Environments."

For indoor noise exposures at all residential uses, the Kings County Noise Element allows  $<45 L_{dn}$  for an 'acceptable' environment, while  $>45 L_{dn}$  is listed as 'unacceptable.'

#### 6.12.1.1.4 Fresno County

Although the project is within Kings County, the boundary of Fresno County is approximately 1,000 feet from the northwest corner of the Project site. There are no potential receptors in Fresno County within approximately 2 miles of the Site. Nonetheless, for completeness, the Fresno County noise standards are included herein.

As with Kings County, Fresno County addresses community noise standards in a Noise Element as part of the county's General Plan (Fresno County, 1975). The following objectives and policies from the Noise Element are applicable to the Project.

#### Objective

- 3.01 "Identify maximum acceptable noise levels compatible with various land use designations."
- 3.02 "Develop a policy framework necessary to achieve and maintain a healthful noise environment."

#### Policies

- 4.01 "The standards contained herein shall be considered general guidelines for developing a noise ordinance that will achieve the intent of this element."
- 4.02 "In order to maintain an acceptable noise environment, the following maximum acceptable noise levels should be established for various land use designations."

Land Use	Daytime	Nighttime	Daily $L_{dn}$	
	$L_{50}$	$L_{50}$	Exterior	Interior
Rural Residential	50 dBA	45 dBA	55 dBA	45 dBA

- 4.06 "Design of all proposed developments should incorporate elements necessary to minimized adverse noise impacts on surrounding land uses and mitigate impacts existing noise levels might have on the proposed development."



#### 6.12.1.2 Site Vicinity

The Site vicinity (Figure 6.12-2) is predominantly in agricultural use. The nearest farmhouses are located approximately 1.3 miles northeast of the Site near the intersection of Avenal Cutoff Road and Orange Avenue, and 1.8 miles southwest of the Site near the intersection of Avenal Cutoff Road and Plymouth Avenue. There are no sensitive receptors in the immediate vicinity of the study area. Farm features in the vicinity are described in Section 6.9, Land Use.

Daytime noise sources in the Site vicinity consist of noise from vehicular traffic on Avenal Cutoff Road, farm operations, the water treatment facility at the California Aqueduct, distant traffic on Interstate 5, occasional aircraft operations and natural sounds (birds and insects). At night, noise from local intermittent traffic on Avenal Cutoff Road is predominant.

#### 6.12.1.3 Noise Measurements

##### 6.12.1.3.1 Methodology

The Commission has developed specific requirements for conducting noise assessments of electric generating facilities. These include performing an ambient noise monitoring program, plus computer modeling of the major facility noise sources to determine projected noise levels at nearby noise-sensitive areas (residences, schools, churches, libraries, etc.) that could potentially be affected. The Commission requires ambient background monitoring for a minimum of 25 consecutive hours from at least one sensitive receptor location.

A noise monitoring program for the Project was conducted in compliance with Commission requirements on April 19 through 20, 2001. The program consisted of continuous and simultaneous 25-hour noise measurements at three monitoring locations and short-term monitoring at two additional locations. Observations at the monitoring locations were made to document local noise sources. Short-term octave band sound level measurements also were performed at the five monitoring locations.

In addition to noise level measurements, the prevailing meteorological conditions were recorded. Wind speed and direction were obtained via a Dwyer hand-held wind meter in conjunction with a map of the local area. Temperature and humidity was measured with a digital thermometer/hygrometer. Sky conditions were observed and recorded at each location.

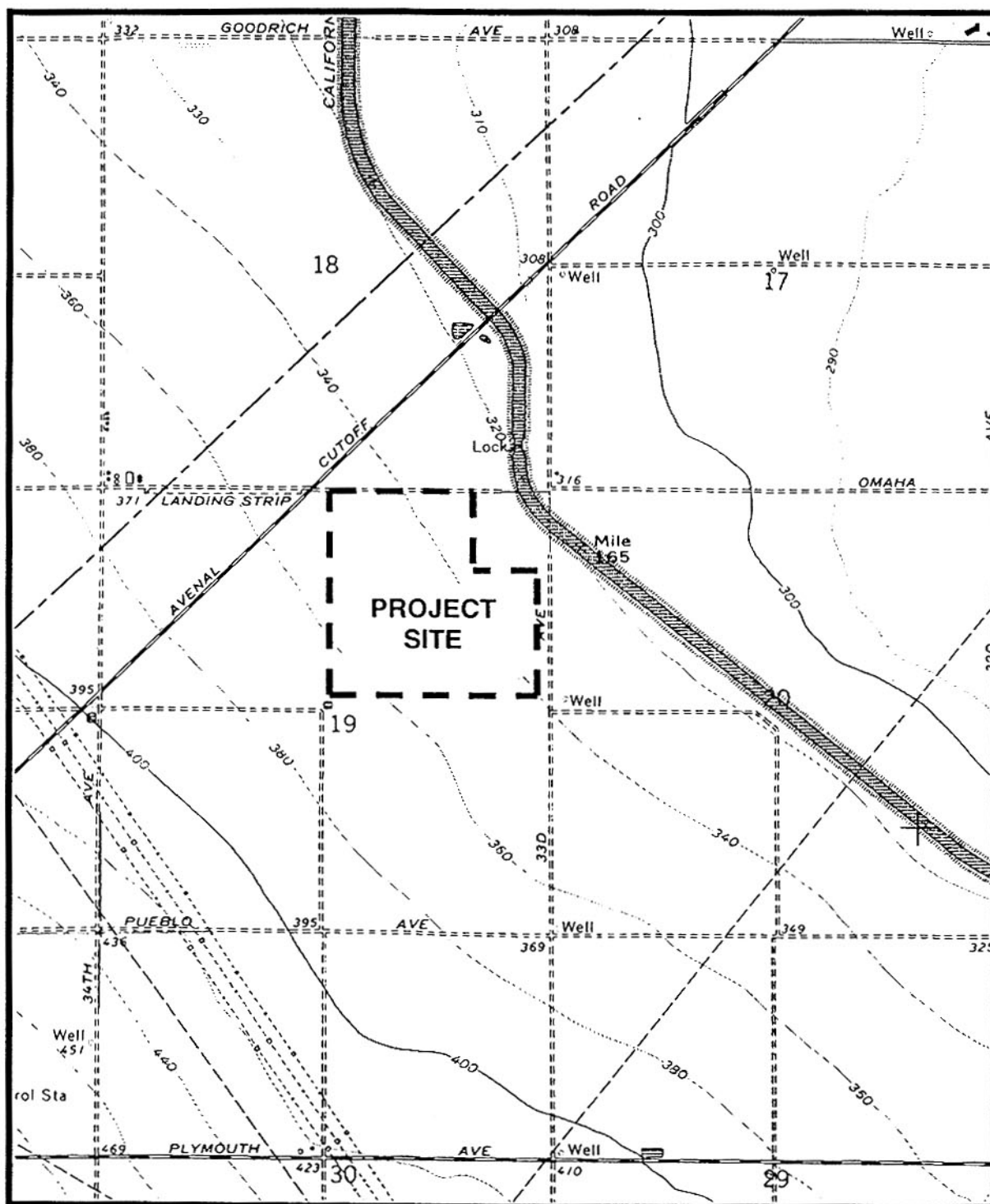


Figure 6.12-2 Topographic Map of the Project Site.

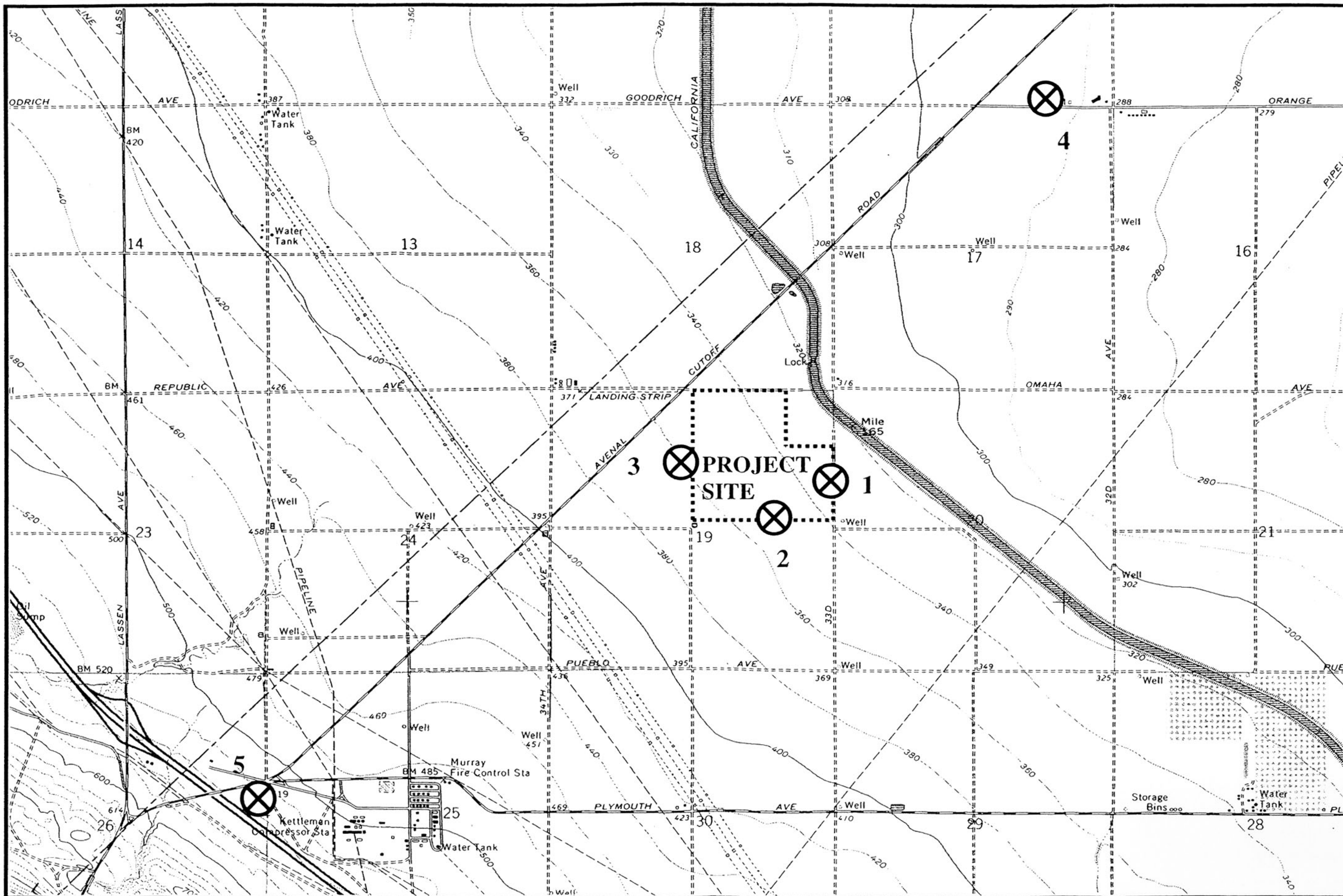
Weather conditions during the survey sessions were noted to be typical for the area in spring. Daytime temperatures ranged from the low-60s °F in the early-to mid-morning to the low-70s °F in the daytime. Evening and nighttime temperatures were in the low-60s °F and the high-40s °F, respectively. The relative humidity was typically between 34 percent and 55 percent. For the most part, there were light or no winds. During the ambient survey effort, there was one brief rain shower.

#### 6.12.1.3.2 Monitoring Locations

Five monitoring locations were chosen to quantify existing baseline noise levels in the vicinity of the Project Site. These locations are described below and are shown in Figure 6.12-3.

- Location 1 - East Boundary: Noise was measured continuously at the Site's east boundary.
- Location 2 - South Boundary: Continuous noise measurements were collected at the Site's southern boundary.
- Location 3 - West Boundary: Noise was continuously measured at the Site's west boundary.
- Location 4 - Nearest Residence to NE: The nearest residence to the northeast is located approximately 1.3 miles from the Site, at the intersection of Avenal Cutoff Road and Orange Avenue. Short-term monitoring was conducted several times during the day and nighttime periods at the front yard property line of this residence.
- Location 5 - Nearest Residence to SW: The nearest residence to the southwest is located approximately 1.8 miles from the Site, at the intersection of Avenal Cutoff Road and Plymouth Avenue. Short-term monitoring was conducted several times during the day and nighttime periods at the front yard property line of this residence.

Locations 1 through 3 are at the Site's east, south and west property boundaries, respectively. Monitoring was also conducted at Locations 4 and 5, which are the two closest residential receptors, located approximately 1.3 and 1.8 miles from the Project site. Typically, residences located further than 1 mile from the Site would not be considered as being within the study area because sound attenuation due to distance spreading loss and ground effects would reduce the Project's noise contributions to values below significance. However, for conservatism and considering the very low ambient noise environments in this undeveloped rural setting, these receptors are addressed in this analysis.



Source: USGS: La Cima, CA; 36120-A1-TF 024; Photoinspected 1978

Figure 6.12-3 Location of the Noise Measurements.

### 6.12.1.3.3 Monitoring Results

#### Continuous 25-Hour Data

Table 6.12-2 summarizes the measured residual ( $L_{90}$ ) noise levels. Data collected at the Site boundary show that daytime and evening noise is affected by intrusive activities such as farm operations and vehicular traffic. The  $L_{90}$  levels were found to be in the range of approximately 29 to 44 dBA at the Project Site. The continuous monitoring data from the survey are shown in Figures 6.12-4 through 6.12-6. The data are presented as a series of curves, corresponding to the measured  $L_{\max}$ ,  $L_{\text{eq}}$ ,  $L_{90}$  and  $L_{\min}$  noise levels. The  $L_{\text{eq}}$  level is representative of all the sounds present. The  $L_{90}$ , residual noise level, is representative of sound produced by sources of relatively constant noise, such as would be expected from the power plant. The  $L_{\max}$  and the  $L_{\min}$  reflect the maximum and minimum sound levels measured during the interval. The spread between the  $L_{90}$  and  $L_{\text{eq}}$  levels provides an indication of the amount of intrusive noise present at any location. A small spread would indicate a steady, constant noise level with few intrusive sounds, as is the case for these locations.

#### Short-Term Data

Short-term noise measurements also were conducted to supplement the continuous data. Results of the short-term monitoring for the two distant noise sensitive locations are also presented in Table 6.12-2.

**TABLE 6.12-2**  
**SUMMARY OF MEASURED RESIDUAL NOISE LEVELS**

LOCATION	RESIDUAL, $L_{90}$ NOISE LEVEL	PROMINENT SOURCE(S)
1 - Eastern Boundary (25-hour data)	30 to 43 dBA	Farming Operations, Water Treatment Facility, Distant Traffic, Frogs, Crickets, and Aircraft Flyby
2 - Southern Boundary (25-hour data)	29 to 42 dBA	Farming Operations, Traffic on Avenal Cutoff, Water Treatment Plant, Birds, and Aircraft Flyby
3 - Western Boundary (25-hour data)	29 to 44 dBA	Farming Operations, Distant Traffic, Water Treatment Plant, Crickets, Birds, and Aircraft Flyby
4 - Nearest Residence to Northeast (short-term data)	35 dBA (late-night)	Farming Operations, Traffic on Avenal Cutoff, Birds, and Aircraft Flyby
5 - Nearest Residence to Southwest (short-term data)	60 dBA (late-night)	Traffic on Avenal Cutoff, Interstate 5, Plymouth Avenue, and Farming Operations

Noise levels collected at Location 4, the nearest residence northeast of the Project Site, were found to be consistent with the Site data (see Figure 6.12-4, Location 1).

The measured sound levels reflect the residual noise level because the instrument was paused when there were vehicle, farm operations or aircraft noise contributions. This data acquisition technique effectively screens out intrusive noise sources and, thus, yields a noise level reading that is consistent with the  $L_{90}$  statistical level (i.e., the residual ambient level). Sound levels at this location were higher during the daytime and lower during the late-night and early-morning periods. The late-night residual ambient noise level was approximately 35 dBA at this location. This is consistent with the measured noise level temporal patterns collected at Locations 1 through 3, with the incremental difference attributed to the proximity of the Location 4 residence to Avenal Cutoff Road.

Data collected at Location 5, the nearest residence to the southwest, reveal a significant and constant contribution from vehicular traffic on Avenal Cutoff Road, Plymouth Avenue and nearby Interstate 5. There was also some contribution from the nearby Kettleman compressor station. As with the other measurement locations, sound levels were higher during the daytime and evening than the late-night periods. The late-night ambient noise level was approximately 60 dBA at this location, due to the aforementioned nearby vehicle and equipment sources.

#### Octave Band Data

Octave band data measurements were also conducted at each of the five monitoring locations during the day, evening, night and early-morning time periods. Because intrusive sounds are typically at a minimum late at night, the nighttime data can be used to describe the tonal nature of background noise. These data are shown in Figures 6.12-7 through 6.12-11. The octave band spectra at the five monitoring locations have the same general downward trend with increasing frequency, which is typical for an ambient environment because higher frequency noises are more readily absorbed in the atmosphere.

#### Summary

The residual noise levels at monitoring Locations 1 through 4 were found to range from 29 to 44 dBA. Location 5 levels were significantly higher due to several nearby vehicle and equipment

Figure 6.12-4  
Ambient Noise Data at Location 1 - East Property Line

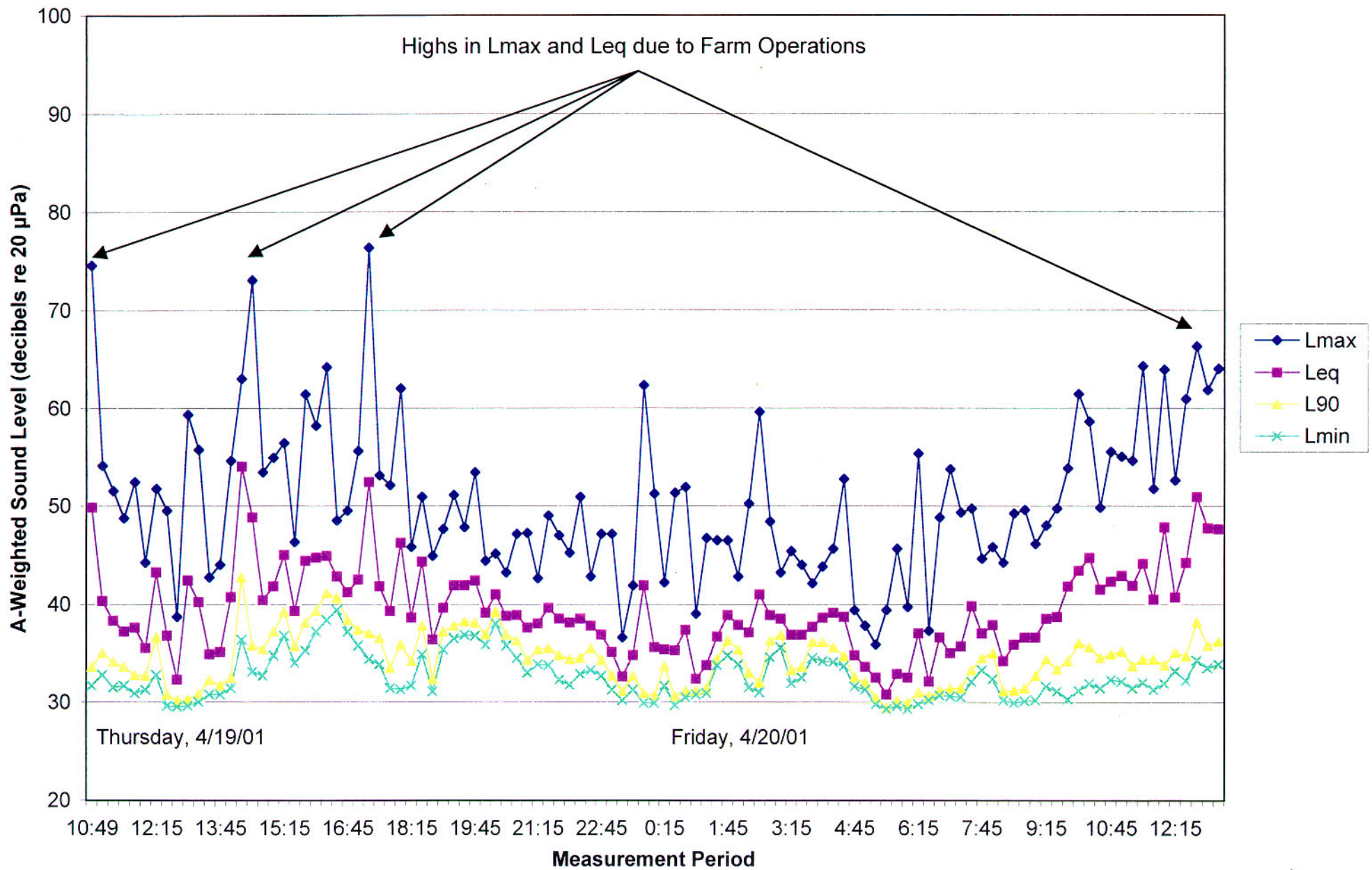




Figure 6.12-5  
Ambient Noise Data at Location 2 - South Property Line

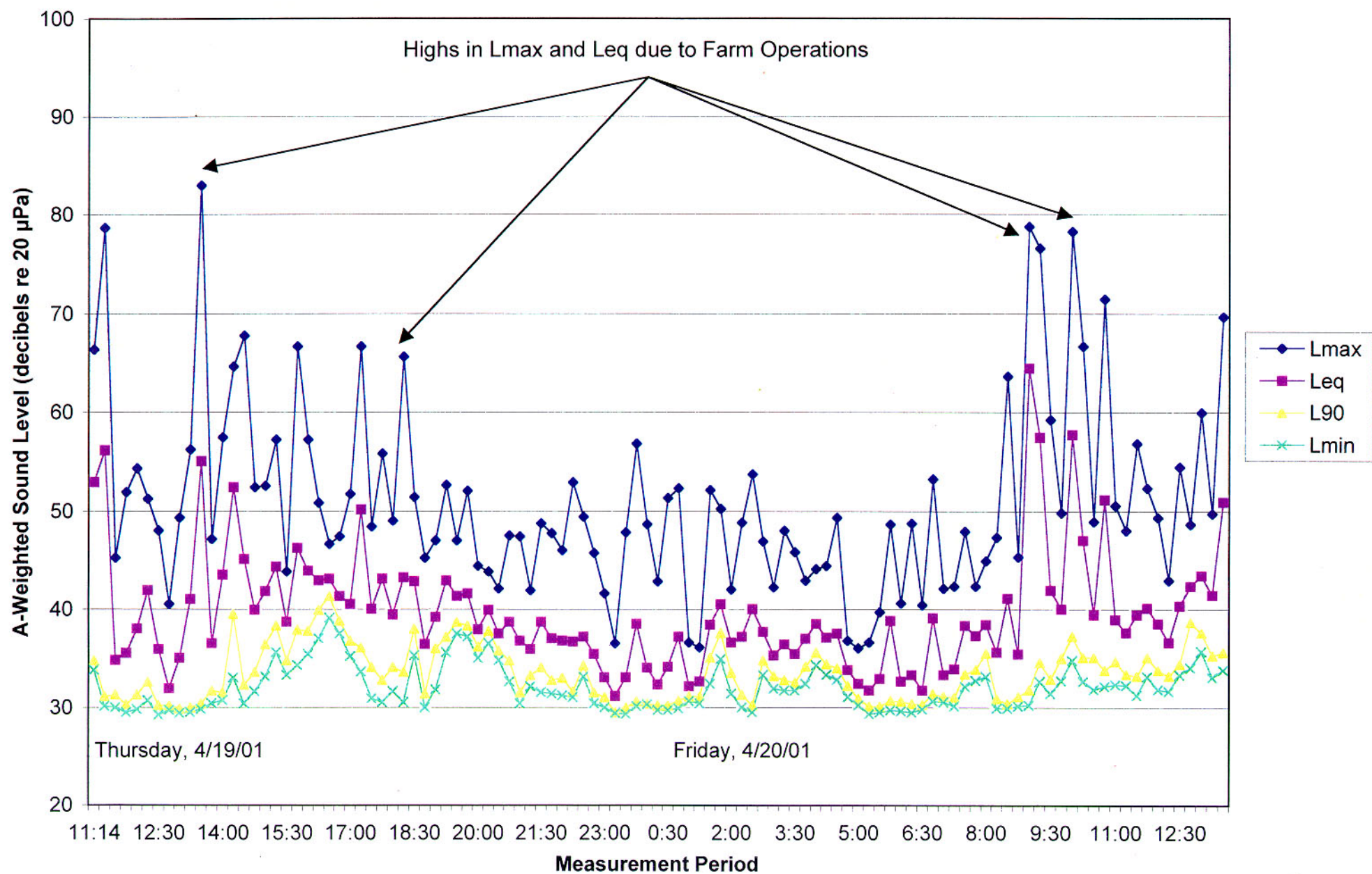




Figure 6.12-6  
Ambient Noise Data at Location 3 - West Property Line

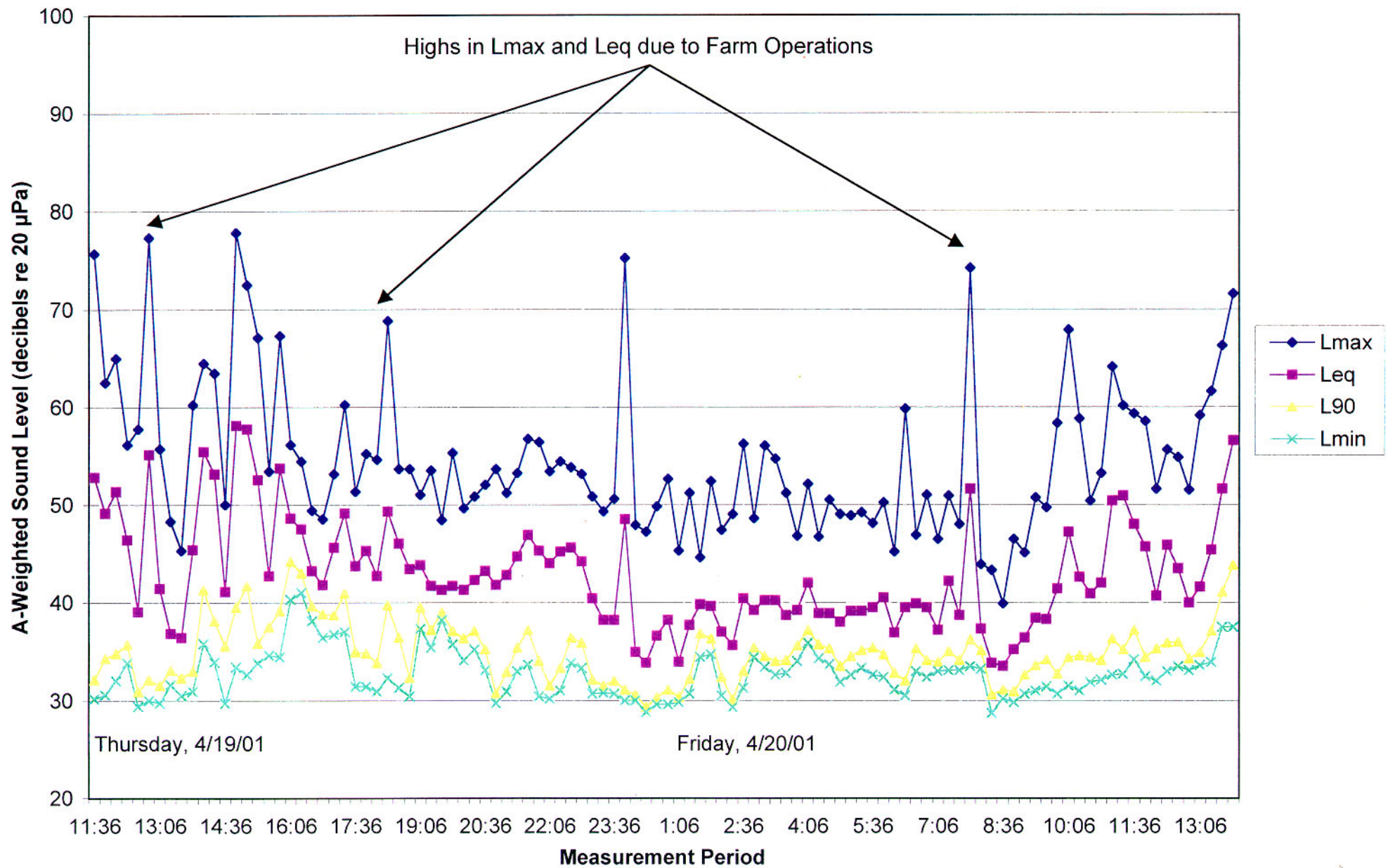


Figure 6.12-7  
Octave Band Measurement Data at Location 1 - East Property Line

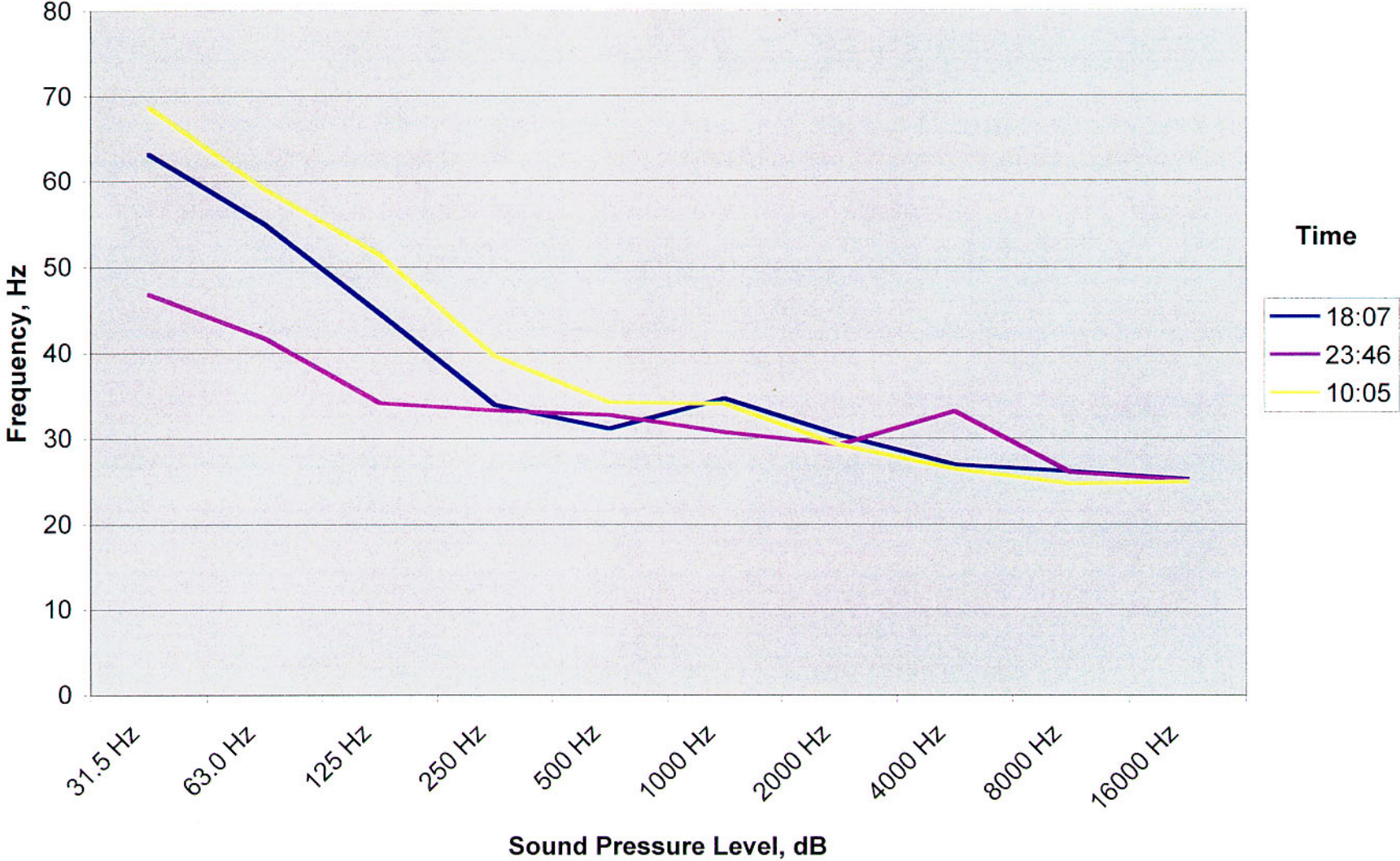




Figure 6.12-8  
Octave Band Measurement Data at Location 2 - South Property Line

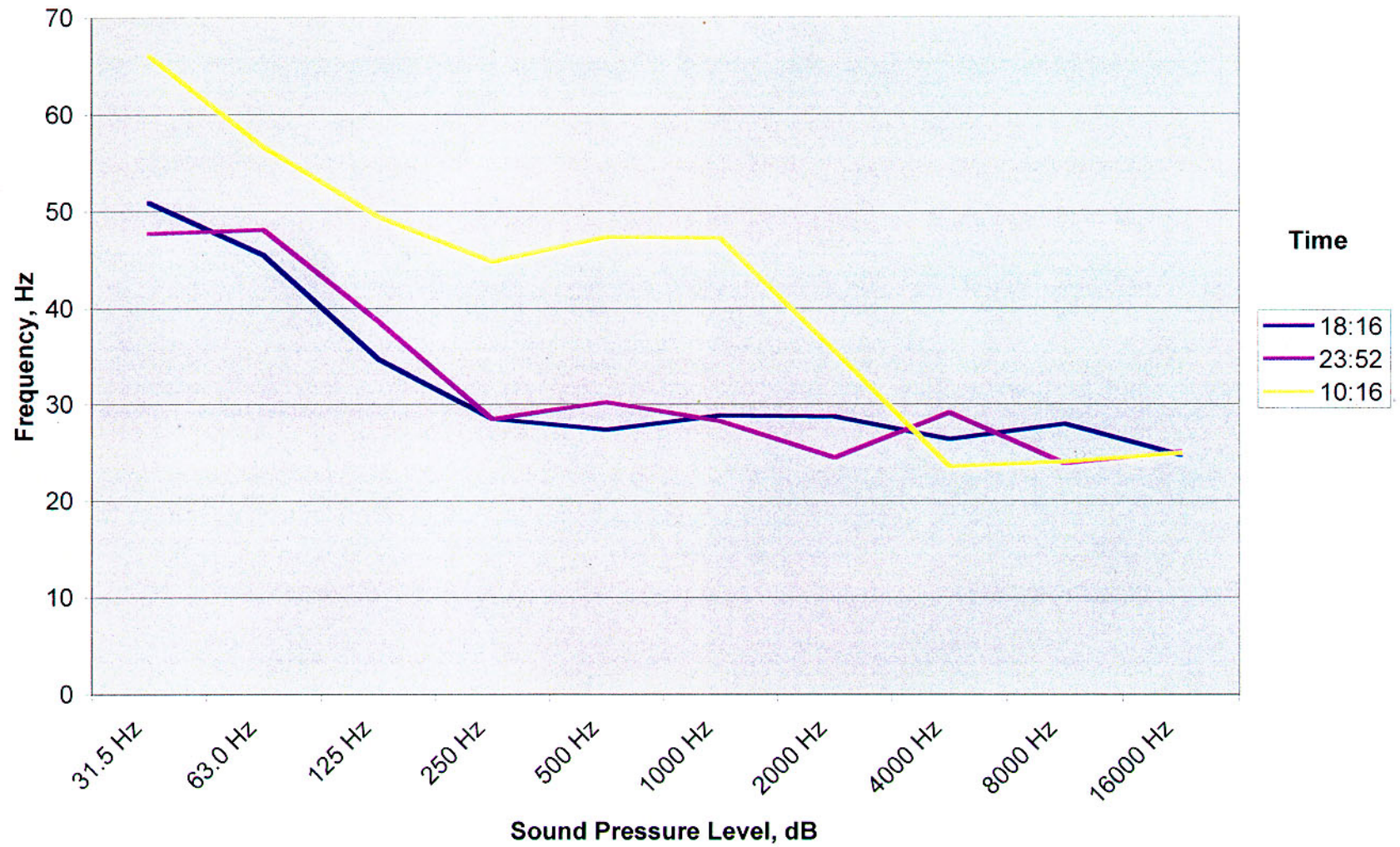


Figure 6.12-9  
Octave Band Measurement Data at Location 3 - West Property Line

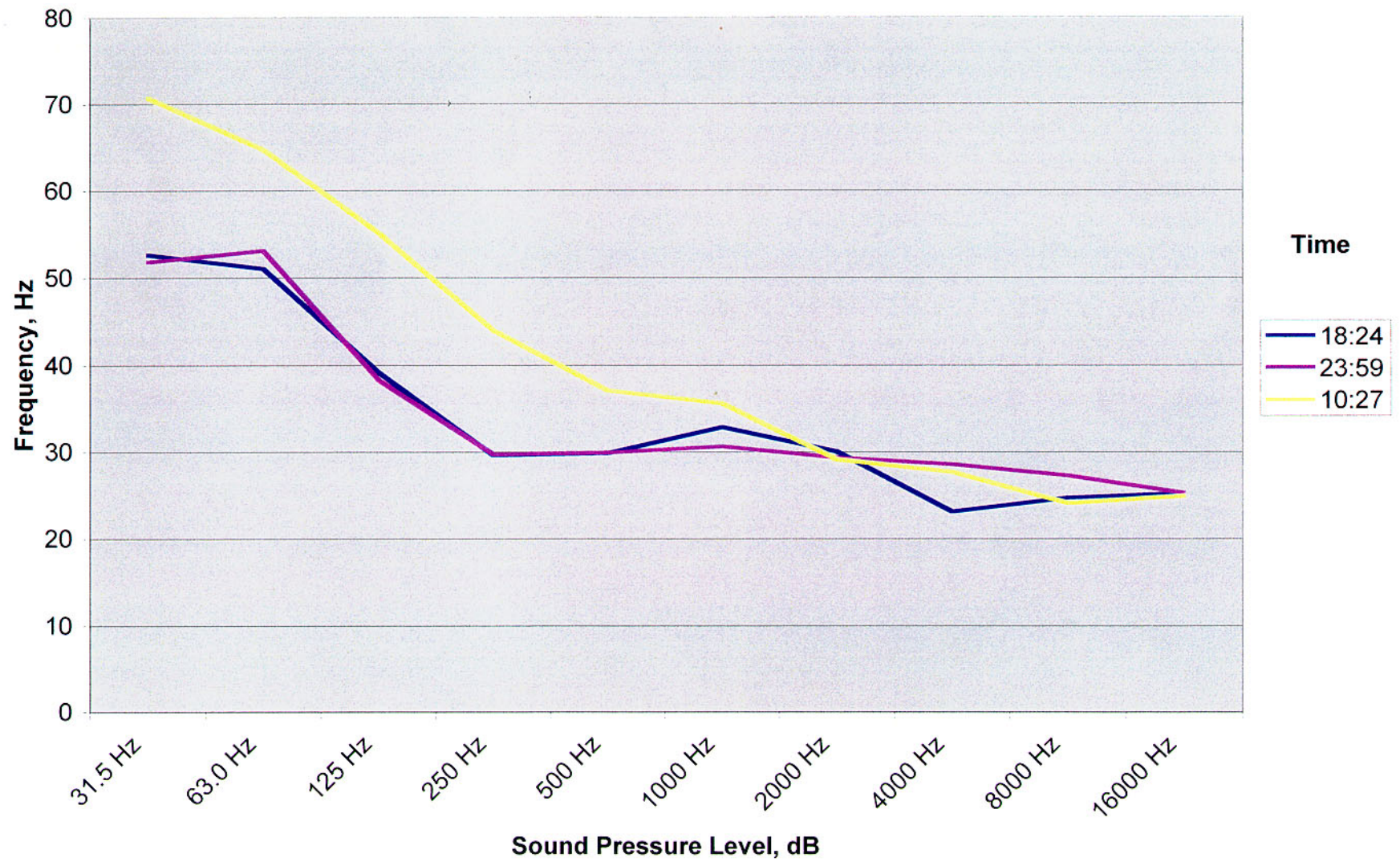




Figure 6.12-10  
Octave Band Measurement Data at  
Nearest Residence to the Northeast, Location 4

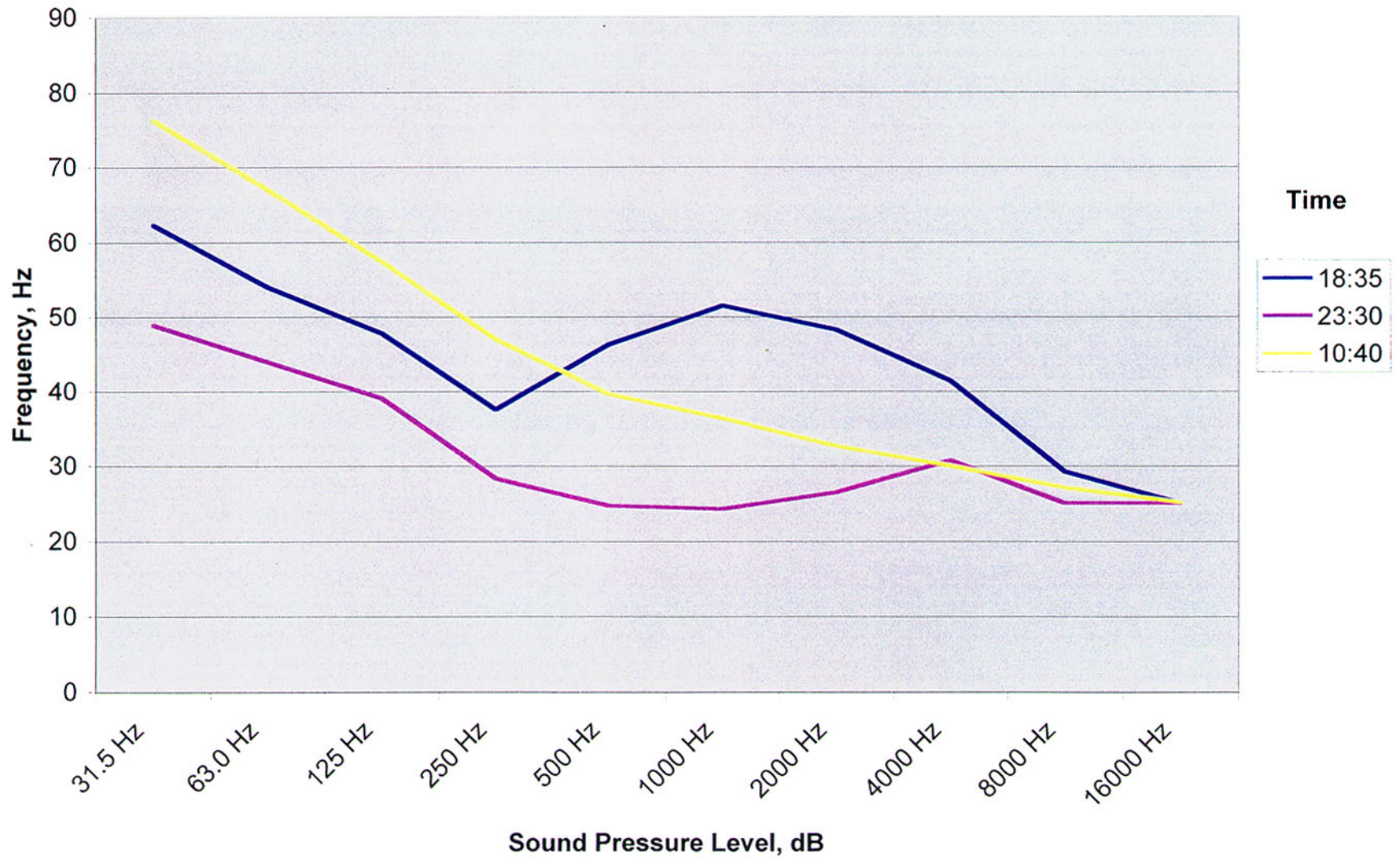
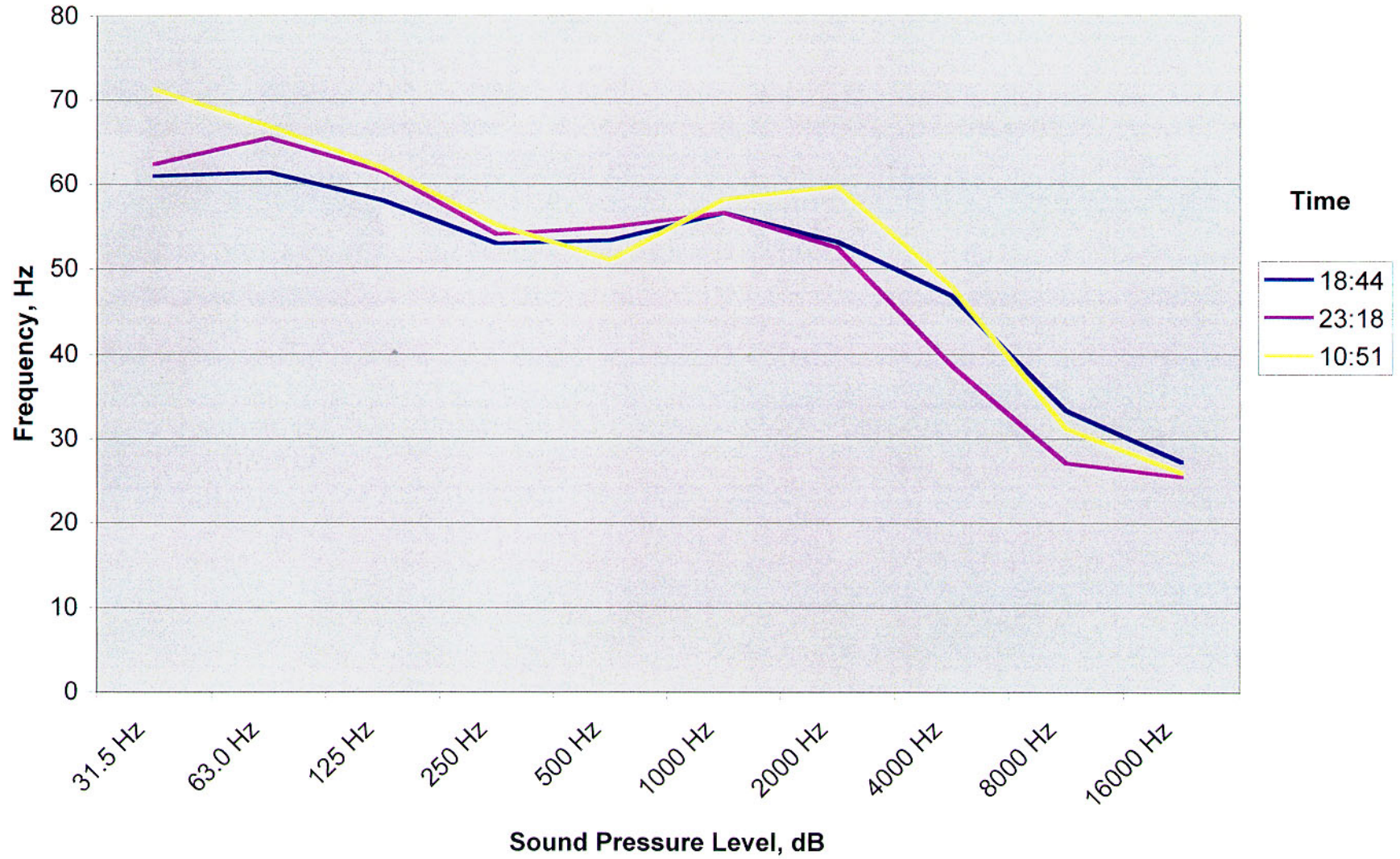


Figure 6.12-11  
Octave Band Measurement Data at  
Nearest Residence to the Southwest, Location 5



sources and would not be considered representative of the ambient environment for the typical areas around the Site. The lowest levels were measured in the late-night and early-morning periods. The short-term data collected at Location 4 (the nearest residential receptor to the northeast at 1.3 miles away) supplemented the 25-hour continuous data and are in good agreement with the Site boundary location data presented in Figures 6.12-4 through 6.12-6.

### 6.12.2 IMPACTS

Significance criteria were determined based on CEQA Guidelines, Appendix G, Environmental Checklist Form (approved January 1, 1999) and on performance standards or thresholds adopted by responsible agencies. An impact may be considered significant if the Project results in:

- Exposure of persons to or generation of noise levels in excess of standards established in the City of Avenal General Plan Noise Element.
- Exposure of persons to or generation of noise levels in excess of standards established in the Kings County General Plan Noise Element.
- An increase in the existing late night residual  $L_{90}$  noise levels by 5 dBA or more at a noise sensitive location, which is the threshold that has been determined to be significant by the Commission.
- A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project.
- A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project.

To analyze the noise impacts of the Project, a proprietary computerized noise prediction program was used to simulate and model the noise propagation from the Project. This model uses industry-accepted propagation algorithms based on standards written by CONCAWE<sup>(1)</sup>. The calculations account for classical sound wave divergence (spherical spreading loss with adjustments for source directivity from point sources) plus attenuation factors due to air absorption, minimal ground effects and barrier/shielding<sup>(2)</sup>. This model has been validated over the years via noise measurements at several operating plants that had been previously modeled during the engineering design phases. The modeling study used plant layout configurations and equipment information for the Project from Duke/Fluor Daniel (D/FD), an engineering and

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<sup>(1)</sup> CONCAWE is the oil companies' European organization for environment, health and safety; headquartered in Brussels, Belgium. The noise propagation standard was originally published in 1981 under the title "The Propagation of Noise From Petroleum and Petrochemical Complexes to Neighboring Communities." Parts of this method are also included in the ISO 9613, ISO 1913 (Part 1), ANSI 126, or ISO 3891 standards.

<sup>(2)</sup> For ease of use and computational efficiency, the PC model does not provide for special screening effects or for complex meteorological variables.



construction company that is performing front-end engineering in support of the Project. Specifically, the study focused on the potential noise generated by the proposed two trains of gas-fired combustion turbines (General Electric Frame 7FAs), two HRSGs, a STG with steam condenser, a nine-cell wet cooling tower, large water pumps, and three main power transformers. Items that were considered as insignificant sources, such as pumps less than 20 horsepower, were excluded from the analysis.

The pertinent USGS topographical "quad" maps and the D/FD plot plan drawing (D/FD, 2001), were used to establish the overall noise analysis area and the position of the noise sources and receptors, respectively. Modeling receptors used the same receptor locations as the ambient monitoring locations. The source and receptor locations were translated into input coordinates for the noise modeling program.

All continuous-operation equipment items that were deemed to be significant Project noise sources were included in the baseline noise model. The plant was conservatively assumed to operate at maximum loads for 24 hours per day, which means its noise output would be constant, regardless of time of day. This scenario is conservative because electricity demand normally ramps downward at night when commercial activities decline and when residential usage decreases (as people turn off lights, televisions and appliances before going to sleep). Nevertheless, the modeling was performed assuming 24 hours of maximum loads to assure that even under this unusual condition, the Project will comply with Commission noise control requirements as well as with pertinent local jurisdictional requirements at all hours of the day and night. Also for conservatism, and as is standard practice in the description of environmental noise, the modeling assumed stable atmospheric conditions (suitable for reproducible measurements) that are favorable for propagation. These factors and other conservative assumptions in the modeling process will tend to predict higher values than would be expected in the real-world environment around the Site. Calculations in the predictive model are performed using octave band sound power levels (abbreviated PWL or  $L_w$ ) as inputs from each noise source. Rather than use estimated source inputs levels that can be calculated from accepted industry references<sup>(3)</sup>, the modeling inputs used noise emission values that were obtained from equipment vendors on several recent D/FD design efforts that use similar Frame 7FA-based plant configurations. This use of vendor-supplied noise level information for the specific equipment that is planned for the Project means that the modeling has a higher level of accuracy compared to modeling done with generic type and size information for the power plant equipment.

---

(3) Such as the Edison Electric Institute Technical Report, "Electric Power Plant Environmental Noise Guide."



The computer outputs are in terms of octave band and overall A-weighted sound pressure levels (abbreviated SPL or  $L_p$ ) at discrete receptor positions or at grid map nodes (in preparation for computing a contour map). The output listing is ranked by relative noise contribution from each noise source. The following discussion presents noise modeling results to determine how future conditions, with the Project, will comply with applicable local and state noise requirements.

#### 6.12.2.1 Construction-Related Noise

The construction process for this type of facility generally creates noise during the following phases:

- Site preparation
- Pile installation
- Foundation placement
- Building construction
- Exterior finish and cleanup

Construction equipment utilized will differ from phase to phase. In general, heavy equipment (bulldozers, dump trucks and concrete mixers) will be used during excavation and concrete pouring activities. Most other phases involve the delivery and erection of the building components.

Noise levels of construction equipment typically utilized for this type of project are presented in Table 6.12-3. It is important to note that the equipment presented is not used in each phase of construction. Further, equipment used for a particular function is not generally operated continuously, nor is the equipment necessarily operated simultaneously. Site average sound levels for each phase of construction (Bolt, Beranek and Newman, 1971) are presented in Table 6.12-4. The highest Site average sound levels (95 dBA) are associated with pile installation activities.

The noise levels presented in Tables 6.12-3 and 6.12-4 are for a distance of 50 feet, as well as at the nearest noise-sensitive locations northeast and southwest of the Site. Noise associated with construction of the Project will be attenuated by a variety of mechanisms.

**TABLE 6.12-3**  
**CONSTRUCTION EQUIPMENT NOISE LEVELS**

EQUIPMENT TYPE	EQUIPMENT NOISE LEVEL AT 50 FEET (dBA)	EQUIPMENT NOISE LEVEL AT NEAREST RESIDENCE NORTHEAST OF THE AVENAL ENERGY PROJECT (8,200 FEET) (dBA)	EQUIPMENT NOISE LEVEL AT NEAREST RESIDENCE SOUTHWEST OF THE AVENAL ENERGY PROJECT (11,600 FEET) (dBA)
Truck	91	36	33
Crane	83	28	25
Roller	89	34	31
Bulldozer	80	25	22
Pickup Truck	60	5	2
Backhoe	85	30	27
Jack Hammer	88	33	30
Rock Drill	98	43	40
Pneumatic Tool	86	31	28

*Source: Bolt, Beranek, and Newman, 1971*

**TABLE 6.12-4**  
**PREDICTED CONSTRUCTION NOISE LEVELS**

ACTIVITY TYPE	CONSTRUCTION NOISE LEVEL AT 50 FEET (dBA)	CONSTRUCTION NOISE LEVEL AT NEAREST RESIDENCE NORTHEAST OF THE AVENAL ENERGY PROJECT (8,200 FEET) (dBA)	CONSTRUCTION NOISE LEVEL AT NEAREST RESIDENCE SOUTHWEST OF THE AVENAL ENERGY PROJECT (11,600 FEET) (dBA)
Site Clearing	84	29	26
Excavation	89	34	31
Pile Installation	95	40	37
Foundation	77	22	19
Building Construction	84	29	26
Finishing	89	34	31

*Source: Bolt, Beranek, and Newman, 1971; Alliance Acoustical Consultants, Inc., 2001*

The most significant of these noise-attenuation mechanisms is the attenuation of the sound waves with distance (attenuation by divergence). In general, this mechanism results in a 6 dB decrease in the sound level with every doubling of distance from the source. For example, the 84 dBA average

sound level associated with Site clearing (Table 6.12-4) will be attenuated to 78 dBA at 100 feet, 72 dBA at 200 feet, 66 dBA at 400 feet and so forth. Attenuation for ground effects also was included in the construction noise analysis. The noise sensitive areas are located at various distances from where noise will be produced. The noise sensitive locations are all located more than 1 mile from the Site, so attenuation will be substantial.

During final construction and just prior to the initial plant start-up, a process is used to clean piping and pressure-test systems. This process is referred to as "steam blows" since high-pressure steam is allowed to escape into the atmosphere through an outlet in the steam piping. Steam blows are necessary after erection and assembly of the feedwater and steam systems because the piping and tubing that comprise the steam path accumulate dirt, rust, scale, welding slag and construction debris. The steam blows remove construction debris from the piping to prevent it from entering into and damaging the steam turbine.

A series of short steam blows, lasting 2 or 3 minutes each, will be performed several times daily over a period of 2 or 3 weeks. Steam blows can produce noise as loud as 130 dBA at a distance of 100 feet. The resultant sound level at the nearest receptor to the northeast (Location 4) and the nearest receptor to the southwest (Location 5) will be 60 dBA and 63 dBA, respectively, with consideration for barrier and ground attenuation effects. To minimize these short-term, temporary noise impacts, the piping will be equipped with silencers that will reduce noise levels by 20 to 30 dB, or to an acceptable range of 30 dBA to 40 dBA at the nearest residence (Location 4).

Short-term noise levels during construction activities will not be significant due to the following factors:

- The distance separating the residential areas from the Site will result in substantial attenuation of construction noise. As shown in Tables 6.12-3 and 6.12-4, construction sound levels will often be below measured ambient levels, shown in Table 6.12-2
- The construction equipment will not normally be operating simultaneously.
- During construction, there will be periods of time when no equipment will be operating, and when noise will be at or near ambient levels.
- Construction activities are scheduled to occur during daytime hours, when many people are at work and away from home.
- To reduce construction noise to the greatest extent possible and practical, functional mufflers will be maintained on construction equipment.

The sound levels presented in Tables 6.12-3 and 6.12-4 are those that will be experienced by people outdoors. A building provides significant attenuation for those who are indoors. Sound levels can be expected to be as much as 27 dB lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by as much as 17 dB (EPA, 1974).

Construction impacts of the Project will be temporary, lasting for approximately 20 months. The construction activities will be focused on the Site only and will not disrupt surrounding land uses.

#### 6.12.2.2 Operations Noise

Future predicted noise levels for the Project are shown in Table 6.12-5.

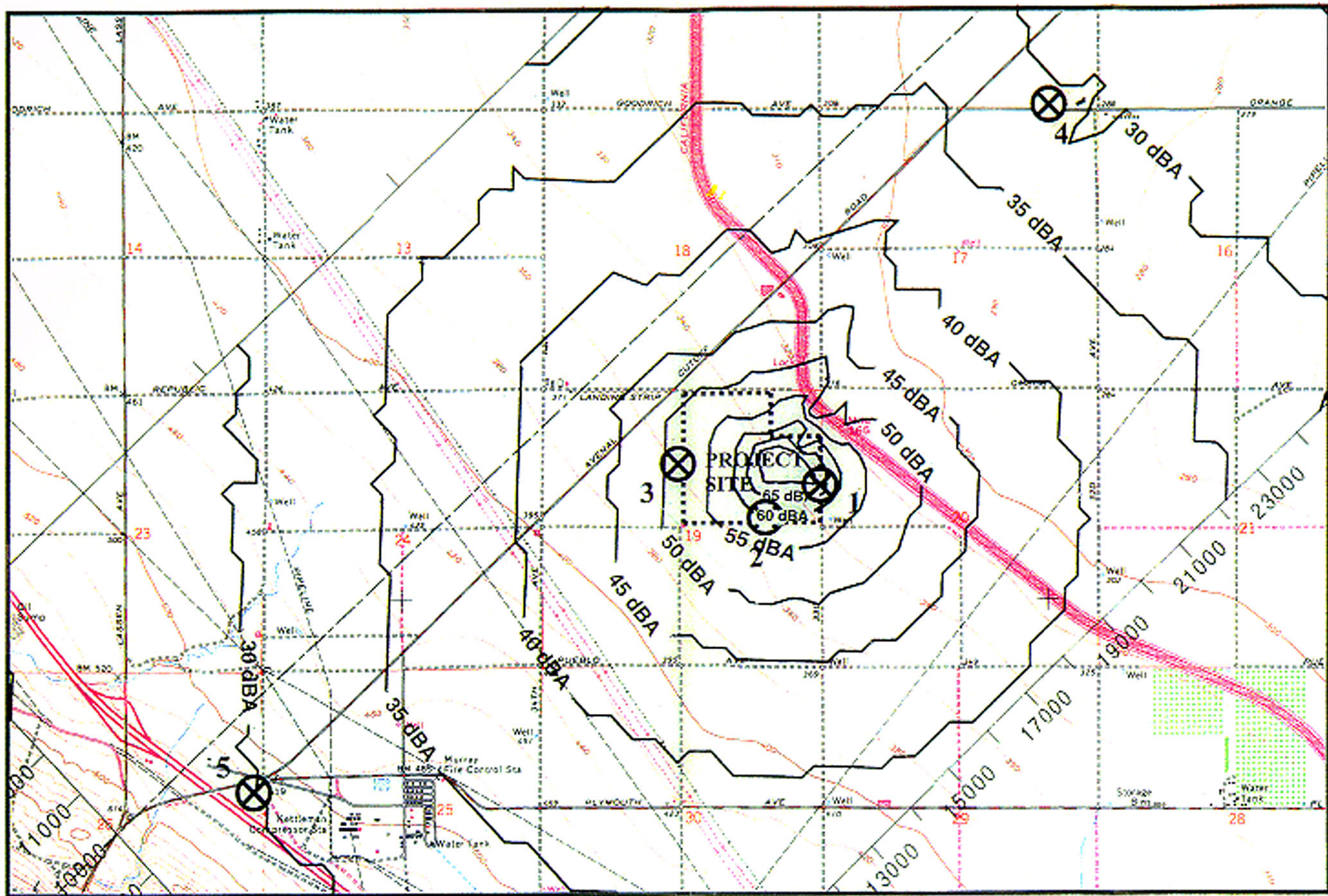
**TABLE 6.12-5**  
**PREDICTED PROJECT NOISE LEVEL**

LOCATION	APPROXIMATE DISTANCE TO CENTER OF PLANT (feet)	PREDICTED PROJECT NOISE LEVEL (dBA)
Site North Property Line	1,600	51
Site East Property Line	830	65
Site South Property Line	920	61
Site West Property Line	1,700	52
Nearest Residence to the Northeast	8,200	32
Nearest Residence to the Southwest	11,600	29

The future plant noise level at the Site's north, east, south and west property boundary will be approximately 51, 65, 61 and 52 dBA, respectively. Further, land uses adjacent to the Site are agricultural, and there are no noise-sensitive receptors or uses located adjacent to the Site boundaries. Therefore, no noise impact is expected along the Site boundaries.

More importantly, the predicted plant noise level will be approximately 32 dBA at the nearest residence located northeast of the plant, Location 4. At the nearest residence located southwest of the plant, Location 5, the future plant noise level will be approximately 29 dBA. The Project noise level contributions are shown graphically in Figure 6.12-12, which provides the predicted noise





Sources: USGS: La Cima, CA; 36120-A1-TF 024; Photoinspected 1978  
Contours: Alliance Acoustical Consultants, Inc., 2001

Figure 6.12-12 Predicted Noise Level Contours around Avenal Energy Project



level contours for the areas around the Site. Modeling details and methodology are presented in more detail in Appendix 6.12.

#### 6.12.2.3 Commission Requirement (+5 dB criterion)

The Commission has determined that a significant noise impact may occur if noise from a new facility increases the existing late-night average residual noise levels,  $L_{90}$ , by 5 or more dBA at nearby residential areas. Provided in Table 6.12-6 are the modeled facility noise levels at the nearby residential areas, the existing late night residual noise levels ( $L_{90}$ ), the projected future noise level with the Project in operation, and the projected increase in noise. The noise increases attributed to the Project will be approximately 2 dB at the nearest residence to the northeast (Location 4). At the nearest residence to the southwest (Location 5), the Project will not be expected to result in an increase above existing ambient noise levels. Future noise increases attributed to the Project will be less than 5 dB at the surrounding residential locations because of the distance between the Project and each residential location. The Project will therefore not cause a significant noise impact and will be in compliance with the Commission's criterion.

**TABLE 6.12-6**  
**NIGHTTIME RESIDUAL NOISE LEVEL**  
**AND PREDICTED PROJECT NOISE LEVEL**

LOCATION	SOURCE TO RECEPTOR DISTANCE (feet)	RESIDUAL ( $L_{90}$ ) AMBIENT NOISE LEVEL (dBA)	PREDICTED PROJECT NOISE LEVEL (dBA)	CUMULATIVE (AMBIENT PLUS PLANT) NOISE LEVEL (dBA)	PROJECT CHANGE, (dB)
4 - Nearest Residence to the Northeast	8,200	35	32	37	+2
5 - Nearest Residence to the Southwest	11,600	60	29	60	+0

#### 6.12.2.4 City of Avenal Noise Element

Results of the noise analysis with respect to the City of Avenal Noise Element are shown in Table 6.12-7. As indicated, the  $L_{eq}$  from the Project are well below the City's daytime and nighttime standards of 50 dBA and 45 dBA, respectively, at noise-sensitive farmhouse receptors.

Consequently, the Project will comply with the City of Avenal Noise Element, and Project noise will be less than significant. It is noted that the nearest residence to the northeast, Location 4, is not located within the City of Avenal. However, for conservatism, this location also was evaluated for compliance with the City's noise standards.

**TABLE 6.12-7**  
**PREDICTED PROJECT NOISE LEVEL AND CITY OF AVENAL NOISE STANDARDS**

LOCATION	SOURCE TO RECEPTOR DISTANCE (feet)	PREDICTED PROJECT NOISE LEVEL (dBA)	CITY OF AVENAL NIGHTTIME $L_{max}$ NOISE STANDARD (dBA)	CITY OF AVENAL DAYTIME/ NIGHTTIME HOURLY $L_{eq}$ NOISE STANDARD (dBA)	ASSESSMENT
4 - Nearest Residence to the Northeast	8,200	32	65	50/45	Compliance
5 - Nearest Residence to the Southwest	11,600	29	65	50/45	Compliance

#### 6.12.2.5 Kings County Noise Element

To comply with the Kings County Noise Element guidelines, noise levels from the Project must fall within applicable noise range levels at the nearest residence located northeast of the Site (Location 4). The Site, as well as the nearest residence to the southwest, are located within the City of Avenal limits, and the City's noise standards take precedence above the County's Noise Standards for these locations. However, for conservatism, these locations also are evaluated for compliance with the Kings County Noise Element in Table 6.12-8.

**TABLE 6.12-8**

**FUTURE PROJECT NOISE LEVEL  
AND KINGS COUNTY NOISE ELEMENT GUIDELINES**

Location	Source to Receptor Distance (feet)	Predicted Project Noise Level $L_{dn}$ (dBA)	Kings County Noise Element Guideline $L_{dn}$ (dBA)	Assessment
Site North Property Line	1,600	57	75	Compliance
Site East Property Line	830	71	75	Compliance
Site South Property Line	920	67	75	Compliance
Site West Property Line	1,700	58	75	Compliance
Nearest Residence to the Northeast	8,200	38	65	Compliance
Nearest Residence to the Southwest	11,600	35	65	Compliance

As indicated, in all instances, the  $L_{dn}$  for the Project will be at or below the exterior noise exposure allowance of  $L_{dn}$  65 dBA for rural residential uses and agricultural uses. Specifically, at the nearest residence to the northeast (Location 4), the Project-generated  $L_{dn}$  will be approximately 38 dBA, well below the County's 65 dBA guideline. At the nearest residence to the southwest (Location 5), the Project-generated  $L_{dn}$  will be approximately 35 dBA, also well below the County's 65 dBA guideline. At the north, east, south and west Site boundaries, the  $L_{dn}$  will be 57, 71, 67 and 58 dBA, respectively. The  $L_{dn}$  at the Site boundary will be at or below the County's 75 dBA guideline. Consequently, the Project will comply with the Kings County Noise Element. Noise from the Project, based on the Kings County Noise Element, is considered less than significant.

#### 6.12.2.6 Fresno County Noise Element

There are no receptors in Fresno County within 2 miles of the Site. Using the information from Table 6.12-8 for a potential receptor at this distance (i.e., comparable to Location 5), the predicted Project noise level in terms of  $L_{dn}$  will be approximately 35 dBA. If this is compared to the Fresno County exterior  $L_{dn}$  limit of 55 dBA, the predicted noise is 20 dB below the county standard. Thus, noise from the Project, based on the Fresno County Noise Element, is considered less than significant.

#### 6.12.2.7 Onsite Noise Levels

Onsite management of noise is governed by Federal OSHA/Cal-OSHA. Cal-OSHA requires hearing protection for workers exposed to noise levels greater than 85 dBA for extended periods.



The modeling indicates that, at close range, noise levels of 85 dBA or greater may be experienced in localized areas that have a high density of equipment noise sources. For these areas, worker hearing conservation will be addressed via hearing protection devices, limited access time, and health and safety training. Consequently, onsite impacts to employees from the Project will not be significant, as hearing protection and training procedures will be implemented as part of a Project health and safety program.

#### 6.12.2.8 Audible Switchyard/Transmission Line Noise Levels

During operation, the existing transmission line will emit a corona, or hum, which is somewhat audible immediately beneath the line and slightly audible for up to approximately 100 feet on either side of the line. This level of noise will not have a significant impact on the surrounding environment because the nearest receptors are located much more than 100 feet away from the line. The switchyard also will be located away from inhabited areas and is not expected to generate noise that will be significantly additive to other Project noise levels.

#### 6.12.2.9 Cumulative Effects

Activities in the region that have the potential for cumulative impacts are identified in Section 6.1.4. The City of Avenal water turnout relocation is the only other foreseeable action that is close enough to have cumulative noise impacts with the Project. The water turnout relocation will be a short-term construction project that will involve earthwork, concrete and pipework, and other activities typical of construction sites. The nature of the construction noise will be similar to noise identified for the Project in Table 6.12-3. Relocation of the turnout will overlap with a portion of Project construction activities and will occur adjacent to the Site. The construction activities will be far from sensitive receptors and, therefore, will be substantially attenuated. The cumulative noise impact will be less than significant due to the short duration of the combined construction activities and attenuation by distance to the closest sensitive receptors.

### 6.12.3 PROJECT DESIGN FEATURES

As discussed above, the Project will not generate any significant noise impacts. Thus, special Project noise control design features are not required. This is because the new combined-cycle units are state-of-the-art facilities that are designed to operate at low noise levels. This inherent characteristic of a modern power plant design, coupled with distances of more than 1 mile to the nearest residential receptors, will yield a facility that will produce no noise burden on the areas

surrounding the Project Site. To assure and confirm that noise impacts remain insignificant, the following noise reduction measures are incorporated in the Project design:

- Fixed or mobile construction equipment will be equipped with properly operating and maintained muffler exhaust systems.
- Temporary silencers on air and steam discharge vents will be used during Project commissioning and initial startup phases. This will reduce noise from the few weeks of air and steam blow cleaning that only occurs during this part of the plant's life cycle.
- A noise survey will be performed within 90 days of the startup of commercial operations to verify that the modeled noise levels are met. Any deficiencies will be noted, and a schedule to correct them will be developed. A copy of the report will be provided to the Commission and the City of Avenal, which will be kept apprised of progress made toward correcting any noise-related issues.
- An OSHA level noise survey will be performed to assess the general location of the 85 dBA noise level contour with respect to a potential worker safety demarcation line (in support of conformance with OSHA hearing protection regulations).

#### 6.12.4 MITIGATION MEASURES

The Project will meet: (a) Commission noise limits, shown in Table 6.12-6; (b) City of Avenal Noise Element limits, shown in Table 6.12-7; (c) Kings County Noise Element Standards, shown in Table 6.12-8; and (d) the Fresno County Noise Element. Since no significant impacts have been identified, no mitigation measures are required.

#### 6.12.5 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

There are no significant unavoidable adverse noise impacts from Project construction or operations.

#### 6.12.6 LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

A summary of applicable LORS pertaining to noise is provided in Table 6.12-9. Construction, operation and maintenance of the Project will occur entirely within the City of Avenal and will be in compliance with applicable LORS pertaining to the City's noise requirements. In addition, the Project will be within compliance of the Kings County and Fresno County Noise Elements. Lastly, the Project will comply with the Commission's noise requirement regarding increases in noise levels at sensitive receptors.

**TABLE 6.12-9**  
**NOISE CONTROL LORS AND COMPLIANCE**

JURIS-DICTION	LORS/AUTHORITY	ADMINISTERING AGENCY <sup>(1)</sup>	REQUIREMENTS/ COMPLIANCE	APPROACH TO COMPLIANCE	AFC SECTION/PAGES
Federal	EPA Noise Guidelines, 1974.	None applicable.	Guidance Level.	None applicable.	Section 6.12 - Noise Control; Pages 6.12-1 through 6.12-43
	Occupational Safety and Health Act of 1970 (OSHA); 29 CFR §1919 et seq.	Fed-OSHA.	Comply with worker noise exposure standards.	Duke Avenal will comply with OSHA worker noise exposure standards.	Section 6.12.2.7 - Onsite Noise Levels Page 6.12-39, 6.12-40
	Noise Control Act 1972) as amended by the Quiet Communities Act 1978); 42 USC 4901-4918.	None applicable.	Guidance Level.	None applicable.	Section 6.12.2 - Impacts, Pages 6.12-29 through 6.12-40
State	Cal-OSHA Occupational Noise Exposure Regulations; 8 CCR, General Industrial Safety Orders, Article 105, Control of Noise Exposure, §5095, et seq.	Cal-OSHA.	Comply with worker noise exposure standards.	Duke Avenal will comply with OSHA worker noise exposure standards.	Section 6.12.2.7 - Onsite Noise Levels Page 6.12-39, 6.12-40
	California Environmental Quality Act; 14 CCR 15000 et seq., Appendix G	California Energy Commission.	Provides guidelines for determining when significant noise impact may exist.	This guidance is considered in this AFC analysis.	Section 6.12.2 - Impacts Page 6.12-29 through 6.12-40
Local	City of Avenal General Plan Noise Element	City of Avenal.	See Table 6.12-7	Noise modeling shows that Project will comply with these standards.	Section 6.12.2.4 - City of Avenal Noise Element Page 6.12-37, 6.12-38
Industry	None applicable.	None applicable.	None applicable.	None applicable.	None applicable.

31161/Rpts/AFC/Tbls&Figs (10/6/01/rm)

<sup>(1)</sup> Pursuant to CCR Title 20, Appendix B(h)(1)(B): Each agency with jurisdiction to issue applicable permits and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the Commission to certify sites and related facilities.

There are no permits or approvals required for the Project related to noise control that are outside the jurisdiction of the Commission. Contact information for the City of Avenal is provided in Table 6.12-10.

**TABLE 6.12-10**  
**AGENCY CONTACTS FOR NOISE CONTROL**

AGENCY AND CONTACT	PERMITTING/APPROVAL AUTHORITY
Jim Doughty Director of Planning and Development City of Avenal 919 Skyline Blvd. Avenal, CA 93204 (559) 386-5766	City of Avenal General Plan Noise Element
Larry Spikes County Administrative Officer Kings County Administrative Office 1400 West Lacey Boulevard Hanford, CA 93230	Kings County General Plan Noise Element

#### 6.12.7 REFERENCES

Alliance Acoustical Consultants, Inc., Irvine, California 92618. 2001.

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